

REMARKS

This paper is filed in response to the Office Action dated July 8, 2004, which has a shortened statutory period set to expire October 8, 2004.

Summary of Claim Status

Claims 1-8 are pending in the present application. Claims 1-4 are rejected under 35 U.S.C. 112, and Claims 1-8 are rejected under 35 U.S.C. 102 and/or 103(a) as being anticipated by or unpatentable over Nichani, U.S. Patent No. 6,563,324 (hereinafter Nichani) for the reasons discussed below.

Claims 1, 3, 4, and 5 are amended herein, and Claim 8 is canceled. All other claims remain as filed. No new matter is entered.

Favorable reconsideration of Claims 1-7 in light of the following discussion is respectfully requested.

Rejections Under 35 U.S.C. 112

Claims 1-4 are rejected under 35 U.S.C. 112, second paragraph, for reasons set forth in paragraph 1 (page 2) of the Office Action.

In response to the rejections, Claims 1 and 4 are amended to change "first" and "second" to "stored" and "captured" respectively, thereby correcting an obvious error. No new matter is added.

In addition, Claim 3 to overcome the indefiniteness issue raised by the Examiner. The scope of Claim 3 is not believed to be changed in response to the amendment, and no new matter is added.

For the above reasons, Applicant requests reconsideration and withdrawal of the rejections under 35 U.S.C. 112.

Rejections Under 35 U.S.C. 102

Claims 5-7 are rejected under 35 U.S.C. 102 as being anticipated by Nichani.

In the current paper, Claim 5 is amended to clarify that operation of the die bonding apparatus is terminated "before the IC die is mounted onto the lead frame if one of the second lead frame image and the second die image fails to match the first lead frame image and the first die image, respectively".

Support for this amendment is found in paragraph 0010 of Applicant's specification (page 4):

[0010] In an embodiment of the present invention, a die bonding apparatus incorporates the automatic image matching system such that the comparison process occurs before the die are mounted on the lead frames. A first camera is mounted over the work holder of the die bonding apparatus for capturing the lead frame image. A second camera is mounted over the die loading tray for capturing the die image. The captured die and lead frame images are digitized using a vision card and passed to a computer, which compares the captured die and lead frame images with previously stored die and lead frame images using known techniques. When a mismatch is detected, the computer generates an error signal that is passed through a signal controller to shut down the die bonding apparatus.

In contrast to the present invention, Nichani is directed to the use of a camera to image a semiconductor device for purposes of inspection (see abstract and Fig. 1, both reproduced below for reference):

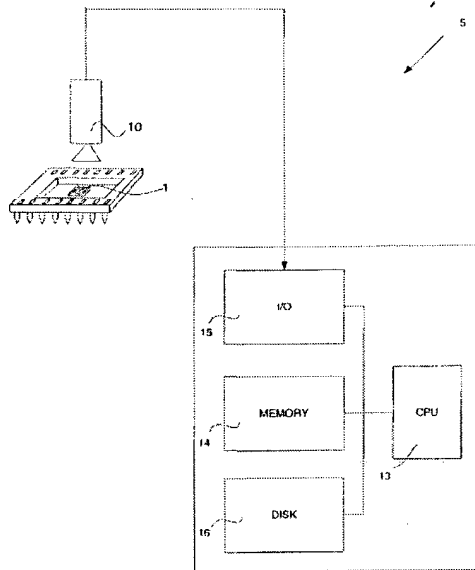


Figure 1

ABSTRACT

A method of inspecting semiconductor die and lead frame assemblies uses rotation invariant/scale invariant processing methods of machine vision data. A training image is acquired and processed to form a training model. A runtime image is acquired and processed using rotation invariant/scale invariant tools to find a runtime instance of the trained model and produce x, y, theta and scale information. The runtime instance is aligned to the train time model, or vice versa, and then compared to the train time model. The features and edges from the runtime image are compared to features and edges of the training model to identify discrepancies as possible defects. The possible defects are further processed with a morphological filter and/or a blob filter to further refine images of the defects. Alternative implementations of the invention measure adhesive wet-out around semiconductor dies and provide measurements of die rotation.

The system taught by Nichani is distinguished over the method recited in Claim 5 in that Nichani appears to be directed to observations taken AFTER a die is mounted on a leadframe, while the focus of the present invention is to identify incorrect leadframes/dies BEFORE the mounting process. For example, Nichani teaches:

1

BACKGROUND OF THE INVENTION

Semiconductor die assembly components and manufacturing operations are very expensive so it is important to inspect the surfaces of the semiconductor die after die bonding. This process is called post bond inspection. Deposits of unwanted adhesive on the die are among the most commonly occurring die bonding defects. Such adhesive deposits can effectively "short circuit" the semiconductor die's electronic functions because the adhesive is typically conductive. Electrical testing of a final assembly would detect such short circuits but only after significant additional manufacturing costs have been incurred.

DETAILED DESCRIPTION OF THE INVENTION

8

During a manufacturing process (runtime) the invention inspects objects of manufacture by comparing them with the training model 44. The objects of manufacture are individually presented to the image capture device 10 which then acquires an image of the object and communicates it to the image analysis system 12. Before a runtime image 46 is

9

compared to the training model 44, the invention uses RISI tools, such as Patmax available from Cognex Corporation or similar tools, to determine the translation and angular orientation of the object. This is a particularly important step during semiconductor die 1 assembly to a lead frame 20 because semiconductor dies 1 are often rotated by substantial amount relative the training time. RISI tools efficiently determine differences in scale and rotation between the training model 44 and the object under inspection.

Further, Nichani is believed to neither teach nor suggest "terminating operation of the die bonding apparatus before the IC die is mounted onto the lead frame if one of the second lead frame image and the second die image fails to match the first

lead frame image and the first die image, respectively", as recited in Claim 5. Accordingly, Claim 5 is believed to be distinguished over Nichani, and reconsideration and withdrawal of the pending rejection is respectfully requested.

Claims 6 and 7 are dependent from Claim 5, and are believed to be distinguished over Nichani for at least the reasons set forth above with reference to Claim 5.

For the above reasons, Applicants request reconsideration and withdrawal of the rejections under 35 U.S.C 102.

Rejections Under 35 U.S.C. 103

Claims 1-4 and 8 are rejected under 35 U.S.C. 103 as being unpatentable over Nichani.

Similar to Claim 5, Claim 1 is amended herein to recite (in pertinent part):

...an automatic image matching system for comparing the captured lead frame image with a stored lead frame image, for comparing the captured die image with a stored die image, and for generating an error signal if one of the captured lead frame image and the captured die image fails to match the stored lead frame image and the stored die image, respectively, wherein the error signal is generated before the IC die is mounted onto the lead frame.

Support for and the benefit amended Claim 1 are the same as those provided above with reference to Claim 5. In addition, amended Claim 1 is believed to be distinguished over Nichani for reasons similar to those provided above with reference to Claim 5.

Claims 2-4 are dependent from Claim 1, and are believed to be distinguished over Nichani for at least the reasons set forth above with reference to Claim 1.

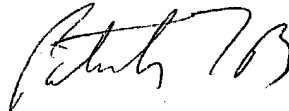
Claim 8 is canceled, thereby obviating the rejection directed to this claim.

For the above reasons, Applicants request reconsideration and withdrawal of the rejections under 35 U.S.C 103.

Conclusion

In light of the above remarks, Applicants believe that Claims 1-7 are in condition for allowance. If any action other than allowance is contemplated by the Examiner, the Examiner is respectfully requested to telephone Applicant's attorney at 408-451-5902.

Respectfully submitted,



Customer no. 022888

Patrick T. Bever
Attorney for Applicants
Reg. No. 33,834

I hereby certify that this correspondence is being deposited with the United States Postal Service as FIRST CLASS MAIL in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450, on September 8, 2004.

Date: 9/8/2004 Signature: Patricia A. Bauman